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(54) **Self-cleaning filter for hydraulic systems fitted with an hydraulic turbine which operates a number of cleaning brushes.**

(57) This invention relates to a self-cleaning water filter which self washes in a counter-current of water operating by means of a turbine which rotates both a set of nozzles through which centrifuged jets of water flow and a set of brushes which scrape the external face of the filtering surface.

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## SELF-CLEANING FILTER FOR HYDRAULIC SYSTEMS FITTED WITH AN HYDRAULIC TURBINE WHICH OPERATES A NUMBER OF CLEANING BRUSHES

This invention relates to a self-cleaning water filter which self-washes in a counter-current by means of the scraping action of a number of rotating brushes, operated by a small turbine, which remove all the particles from the filter net.

This turbine is also used to generate jets of centrifuged water which efficiently clean the filtering surface which in fact undergoes a combined mechanical and hydrodynamic cleaning action.

It is a well known fact that water supplied either from the mains or from a well always contains a certain amount of impurity consisting of solid and colloidal particles, such as sand, slime, rust or lime which can create problems or damage to water supply systems.

In view of this, filters are commonly fitted before the supply mains. Generally these filters consist of containers housing the filtering cartridge made of fabric or synthetic or metal fine mesh net.

These filters can be subdivided into two categories according to the system used for cleaning the mesh when the cartridge is plugged by particles: manual filters and self-cleaning filters.

To clean the first type the operator must open the filter, wash the brushes and cartridge and sometimes even replace the cartridge with a new one.

Self-cleaning filters are specially constructed to automatically unplug the cartridge so that the same passes from the filtering phase to the self-cleaning phase and vice versa, simply by means of a switching device.

The automatic washing of the filtering cartridge in the majority of current self-cleaning filters available on the market is based on the counter-current principle which consists in reversing the water circulation flow within the filter so that the water itself removes the particles trapped in the fine mesh of the filtering cartridge.

The wash water containing the particles in suspension is drained through a special opening until the operating condition of the filtering cartridge is once again ideal.

The major problem related to this water cleaning system in a counter-current of water is that it is not completely efficient since once a section of the filtering surface has been unplugged sufficiently to be drained from the bottom of the cartridge container, the cleaning action stops leaving the remaining filtering surface soiled and plugged forming a layer of filtered particles which subsequently thickens and becomes compact creating an incrustation which is difficult to remove.

It has been experimentally proved that after a

certain number of self-washing cycles, the permanently plugged filtering area becomes so wide that it compromises the capacity of the filter making it necessary to replace the cartridge.

The filter according to this invention has been designed to resolve these problems since the filter not only uses the traditional water cleaning system in a counter-current but is also fitted with a set of rotating brushes whose mechanical scraping action removes the particles which plug the mesh of the filtering surface over its entire surface. The cleaning action performed by these rotating brushes is extremely efficient in that the same is combined to an energetic water cleaning action of a number of centrifuged water jets against the internal wall of the filtering surface which is scraped externally by the brushes.

In order to rotate the brushes outside the cartridge and the centrifugation nozzles of the wash water inside the cartridge, the device features a driving turbine operated automatically by the wash water as soon as the switching device strikes the water flow inside the filter to activate the self-cleaning phase.

According to the preferred embodiment of the invention, the filter according to the invention includes a head having the water input and output pipes as well as the above switching valve and a container in which the standard cylindrical filtering cartridge is housed.

The special feature of the device according to the invention is that the head is fitted with a turbine internally which is rotated by the wash water which a special distributor box pushes in a tangential direction with respect to the turbine so as to create a violent impact of the water jet against the blades of the turbine. The latter operates a vertical hollow shaft fitted under the same having radial ejector nozzles along its entire length from which the wash water can be centrifuged on the internal face of the filtering cartridge on whose external surface the impurities are deposited during normal filtering of the water which in normal working conditions passes through the cartridge from outside to inside.

The water cleaning action of the above centrifuged jets is combined to a mechanical scraping action by the bristles of a number of rotating brushes scratching against the external face of the filtering surface.

These brushes are supported along the outside edge by a cylindrical cage whose base bottom has a central boss which is keyed to the above shaft, driven by the turbine.

The high driving torque produced by the latter

not only provides a high kinetic energy to the centrifuged water jets through the pairs of above nozzles but also an energetic and efficient scraping power to the brushes on the external face of the cartridge.

For the sake of major clarity the description of the invention continues with reference to the enclosed tables which are intended for purposes of illustration and not in a limiting sense where:

- fig. 1 is an axial plane cross-section of the self-cleaning filter according to the invention;
- fig. 2 is the cross-section of the filter illustrated in fig. 1 with transverse plane II-II;
- fig. 3 is the cross-section of the filter illustrated in fig. 1 with the transverse plane II-III;
- fig. 4 is a cross-section half-view of the above shaft and turbine;

With reference to the above figures the self-cleaning filter in question includes a head (1), a container (2) and a ring nut (3) for fixing the container (2) under the head (1).

The input (1a) and output (1b) pipes for the filtered water supplied to the system after the filter are fitted on the head (1) diametrically opposite each other.

Inside the head (1) there is a circular distributor box (4) which can oscillate around a vertical center axis; along the outside edge of the distributor box (4) there are two pipes (4a and 4b) which can be moved alternatively into position so that only one of these receives the water from the input pipe (1a) at a time.

The wide radial pipe (4a) conveys the incoming water into the container (2) below and drains it into the space between the walls outside the filtering cartridge (5), so that it is passed with a centripetal direction by the water, which firstly rises up into the cartridge and then is channeled into the output pipe (4c) of the distributor (4), after which there is the output pipe (1b) and is then introduced into the water system duly filtered.

The pipe (4b) is smaller and has a tangential shape since; it is used to give the water from the pipe (1a) a perpendicular direction with respect to the radial blades (6a) of the turbine (6) fitted at the center of the distributor box (4).

In the case of the latter, when the filter is operating during the self-cleaning phase, the water striking the blades (6a) falls immediately into a funnel below (7a) at the top of which there is a hollow shaft (7) along whose length there are opposing radial nozzles (7b) through which the wash water is centrifuged on the internal wall of the filtering surface of the cartridge (5) in that the shaft (7) extends vertically inside the latter which is screwed under the distributor box (4).

This hollow shaft (7) ends at the bottom with an end pin on which the bottom (8a) of a cylindrical

cage (8) is keyed which supports a number of vertical brushes (8b) scraping on the external wall of the filtering surface of the cartridge (5).

Since the funnel (7a) of the hollow shaft (7) is flanged firmly under the turbine (6), when the latter is activated this gives rise to a combined cleaning action of the filtering surface, from inside by the centrifuged water jets from the nozzles (7b) and from outside by the scraping brushes (8b).

The wash water with impurities is drained through a special drain opening (2a) on the bottom of the container (2), which is normally closed by a valve (9), which can easily be opened from the outside by means of the knob (10) fitted above the head (1).

As can be seen in figure 1, the rotation of the knob causes the simultaneous rotation of the distributor box (4) in the same direction and of a vertical rod (11) which passes through the hollow shaft (7) to the bottom of the same and then connects on the valve (9). The conversion from filtering to self-cleaning operation can easily be carried out using the knob (10) above the head (1), which has two stop positions, one with which the water incoming from the pipe (1a) is channeled into the pipe (4a) of the distributor box (4) to then pass through the cartridge (5) from outside to inside and then rise up to the output pipe (1b), the other in which the water incoming from the pipe (1a) is channeled into the pipe (4b) of the distributor box (4) and then rotates the turbine (6), is centrifuged by the nozzles (8b), passes through the cartridge from inside to outside and is finally drained from the bottom of the container (2) passing through the bottom valve (9).

## Claims

1. A self-cleaning filter for hydraulic systems fitted with an hydraulic turbine which operates a number of cleaning brushes, of the type which includes a head (1), a container (2) and a ring nut for fixing the container (2) under the head (1) having the input (1a) for the water to be filtered and output (1b) pipe for the filtered water, in diametrically opposite position, characterized in that the head (1) houses a circular distributor box (4), which can oscillate around a vertical axis, having two pipes (4a and 4b), the one through which the water to be filtered is drained into the underlying container (2) outside the filtering cartridge (5), the other (4b) through which the water for cleaning the filter is conveyed and directed against the radial blades (6a) of a turbine (6) housed in the distributor box (4) which rotates an underlying hollow shaft (7) having radial nozzles (7b) along its length and which terminates at the

bottom with a pin on which the bottom (8a) of a cylindrical cage (8) is keyed for supporting a number of vertical brushes (8b) which scrape against the external face of the filtering surface of the cartridge (5) in that the distributor box (4) can be oscillated by means of a knob (10) fitted above the head (1) which oscillates the underlying rod (11) at the same time and in the same direction; said rod (11) passes through the hollow shaft (7) and comes out at the bottom and connects on valve (9) through which the wash water with the impurities can be drained through the special opening (2a) on the bottom of the container (2).

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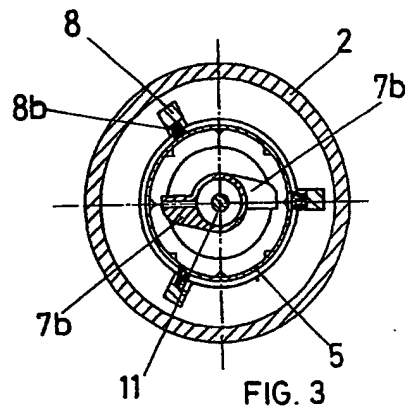
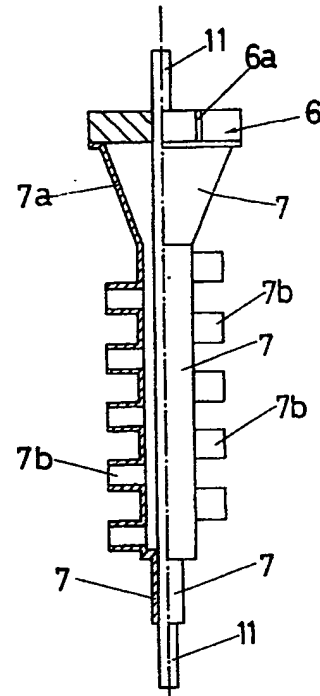
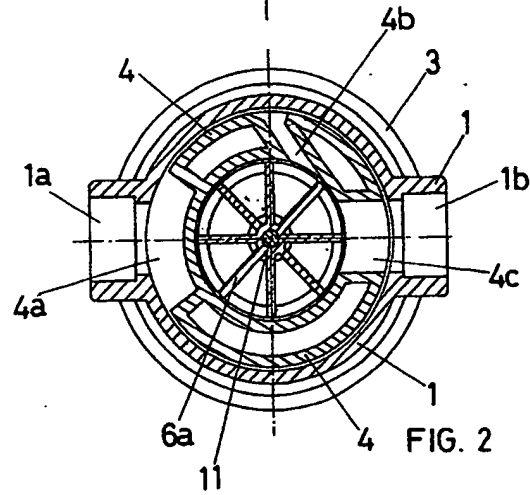
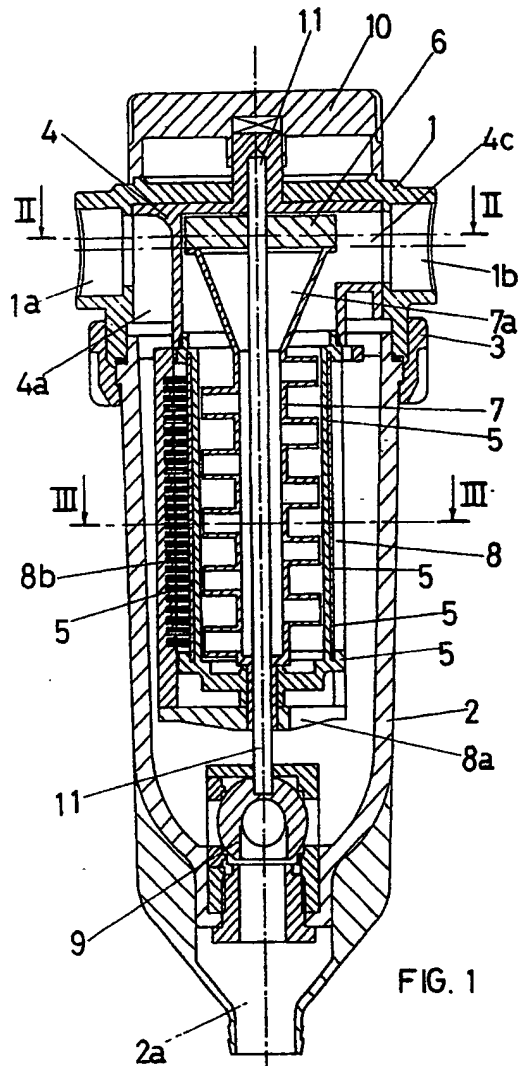
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## EUROPEAN SEARCH REPORT

Application Number

EP 90 83 0510

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	CH-A-3 807 04 (OSCAR PAUSER) * Page 2, lines 83-120; pages 3-4 * -----	1	B 01 D 29/23 B 01 D 29/64
A	US-A-4 046 692 (B.W. BRAUKMANN) * Column 3, lines 44-68; columns 4-6 * -----	1	B 01 D 29/68 B 01 D 29/94
A	FR-A-1 427 506 (LUTHER-WERKE) * Pages 1-2 * -----	1	
A	EP-A-0 347 477 (M. DRORI) * Figures 30,32 * -----	1	
A	DE-A-2 140 349 (HAGIHARA) * Figure 4 * -----		
A	WO-A-8 901 816 (LENOK INSTITUTE FOR RESEARCH) * Figure 2 * -----	1	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			B 01 D
The present search report has been drawn up for all claims			
Place of search		Date of completion of search	Examiner
The Hague		28 February 91	DE PAEPE P.F.J.
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